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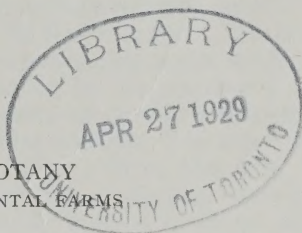
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Pseudomonas Hyacinthi (WAKKER) E.F.S.

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THE YELLOW DISEASE OF HYACINTHS

Pseudomonas Hyacinthi (Wakker) E.F.S.

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F. L. DRAYTON, *Plant Pathologist*

The yellow disease is confined to the garden hyacinth. It is especially important in commercial plantations for it is exceedingly destructive, and under favourable conditions capable of spreading through entire fields, once it has made a start.

SYMPTOMS AND PROGRESS OF THE DISEASE

The first field symptoms of the disease appear towards the tips of the leaves in the form of water-soaked spots or stripes which gradually spread. These areas turn yellow, then brown, and dry up. Frequently the affected tissue forms streaks in the centre of the leaves, with the margins remaining sound. Spotting, browning, and shrivelling may also occur on the flower stalks. The disease progresses from the leaves downwards into the corresponding scales in the bulbs. A diseased bulb is characterized in transverse section by the presence of small yellow spots, which, in a longitudinal cut, are revealed as streaks, gorged with yellow bacterial slime, and corresponding to the vascular bundles. The infection spreads slowly down the affected scales into the basal plate. From this area, the infection progresses in an upward direction in the sap-conducting vessels of other scales. The cells around these vessels eventually become involved and cavities result, which are rapidly invaded by secondary bacteria and fungi, with the result that the bulb is entirely decayed. From the basal plate of a diseased mother bulb the disease may occasionally extend into the daughter bulbs. The accompanying photograph shows, in cross and longitudinal section, the symptoms of diseased bulbs, described above.

In practically every case where hyacinth bulbs fail to grow, either in the field or on being forced, this disease is the cause. By cutting such a bulb longitudinally, it will be found that the basal plate is decayed, as is shown in the photograph. In addition, if any roots have been produced, they have originated in a ring of tissue beyond the margin of the basal plate.

SPREAD OF THE YELLOW DISEASE

Most of the primary infections in the field arise apparently from bulbs in which the disease has penetrated only as far as the neck of the bulb. In such instances, there is good root development, and the shoot grows normally at first; but as it comes into contact with the upper infected portion of the scales, it becomes infected and lesions appear on the leaves as they expand above ground. These primary lesions are dark coloured and exude a bacterial slime which swells up when moist and is spread mainly by splashing rains and air currents to adjoining plants which quickly become infected.*

As far as is known at the present time, the causal organism does not live over in the soil, and the amount of primary infection is dependent upon the number of diseased bulbs planted.

*I am indebted to Dr. J. J. Beijer of the Bulb Research Laboratory at Lisse, Holland, for the information relative to the incidence of the primary lesions.

Besides the methods described above, the organisms may be spread mechanically from diseased to healthy bulbs by means of the knife used for cutting through the plate of mother bulbs in the methods of propagation known as "scoring" and "scooping." This point will be fully discussed when dealing with the methods of control for this disease.

VARIETAL SUSCEPTIBILITY

For many years experienced hyacinth growers in Holland have observed that certain varieties are more susceptible to the yellow disease than others. Among the most popular varieties, the following exhibit some resistance: Gert-rude, Grand Maître, King of the Blues, King of the Yellows, and Yellow Hammer. Among the most susceptible ones are: La Grandesse, Czar Peter, Chas. Dickens, La Neige, Grand Lilas, L'Innocence, Lord Derby, and Queen of the Blues.

These differences in susceptibility offer an excellent opportunity for the breeding of resistant varieties of commercial value; but this will entail great patience, for, with the hyacinth, it is a long and tedious process to obtain blooming bulbs from seed.

CONTROL

During a recent visit to the bulb growing districts of Holland, I was fortunate in being able to gather valuable information in regard to the control of this disease. The following measures have been uniformly adopted there with a great deal of success:

FIELD INSPECTION

Specially trained men are employed by the grower to systematically inspect the fields during the time when the plants are growing actively and the initial infections of this disease are most readily seen. These men devote their entire time to this work until the foliage begins to mature. On sunny days they use large sunshades in order to obtain a subdued light in which the characteristic water-soaked streaks may be more readily detected. When affected plants are found, glass or clay flower pots without a hole in the bottom are immediately inverted over them, and a 10 per cent carbolineum or 5 per cent formaldehyde solution is sprayed on the foliage of the surrounding plants in a circle 4 or 5 feet in diameter, so as to destroy the leaves and check any possible spread of disease which may have started in these plants. The bulbs of the plants under the pots, and those on which the foliage has been killed, are left in the ground until the matured sound bulbs in the field have been dug; then only they are removed and burned. This routine, contrary to the usual practice in dealing with bulb diseases, is followed because of the danger of spreading the disease, if the affected plants were dug and removed from the field when first observed.

In addition, when a number of diseased plants are found in one portion of a field, this area is enclosed with sheets of an asbestos material known as "eternit." These sheets which are about 36 inches long and 28 inches wide are supported by stakes driven into the ground. This measure has been found to be effective in checking the spread of the disease.

Besides the above-mentioned field inspection, there is an additional one by inspectors employed by the Hyacinth Association. These inspectors survey all the hyacinth fields for disease and keep extensive records of every variety cultivated by each grower, and of the presence or absence of disease in the varieties grown. A duplicate of this record is issued to the grower, and constitutes a certificate of health, without the presentation of which no sale of hyacinth bulbs by auction or private transaction can be effected. Furthermore, these reports are most useful to the inspectors of the official Phytopathological Service, who conduct the inspection in the bulb houses prior to shipment of bulbs.

BULB INSPECTION

The presence of the yellow disease in hyacinth bulbs may be detected in two ways:

1. A softening of the bulb, as revealed by gentle pressure with the thumb on the basal plate is usually indicative of a severe infection.

2. By cutting off a thin section from the top of the neck of a bulb even a very slight infection may be detected by the yellow discoloration of the cut scales in the form of rings, segments of rings, or dots, together with a characteristic yellowish ooze. As has been previously described, the progress of the disease is from the leaves into the bulbs and, therefore, it is invariably possible to detect any degree of infection by this method without serious injury to a bulb should it prove sound. In this process the cutting knives may become infected and must be sterilized as described later.

FURTHER METHODS OF CONTROL

As has been previously intimated the treatment of the mother bulbs for propagation purposes has a definite bearing on the spread of the yellow disease. Two methods are in general use, known as "scoring" and "scooping." In the former, two or three cross cuts are made through the basal plate of the bulb intersecting at a point in the middle, and in the latter method, the entire basal plate tissue is scooped out with a curved knife. Which one of these methods is employed depends upon the variety to some extent, but principally on the future market requirements, for scoring gives a smaller number of larger bulblets, which can be increased to marketable size more quickly than the large number of smaller bulblets obtained by scooping. Where yellow disease is present, scooping offers a successful means of eliminating all bulbs which are sufficiently badly attacked to show the symptoms in the basal area. Slight infections, present in the upper part of the bulb, however, would not be detected by this means, but as the growth of the scooped mother bulbs is from the bulblets only, the chances of infection from bulbs of this kind is very small. By the scoring method only, diseased bulbs cannot be detected. The cutting knife may also be a means of spreading the contagion to other bulbs after a diseased bulb has been cut. When on scooping a bulb, it is found to be diseased, the knife should be inserted into a vessel containing either 5 per cent carbolic acid, 5 per cent lysol, 5 per cent formalin, or 1 in 1,000 corrosive sublimate solution, and the scooping continued with another knife which is kept in reserve in the solution.

The last and most important measure, successfully employed by the growers in Holland for the control of the yellow disease, is to subject the planting stock to heat in the bulb houses by means of hot air or hot water heating systems with which these store houses are equipped. The procedure recommended is to raise the temperature of the rooms gradually until, during the whole of September, it is maintained between 99° and 100°F. During October the temperature is gradually reduced to 80° to 85°F.; from then on heating is discontinued to accustom the bulbs to prevailing outdoor temperatures in November, in which month they are usually planted in Holland. It is interesting to note that, when hyacinth bulbs are subjected to moderate heat immediately after being dug, bud development is stimulated and this fact is made use of in the so-called "preparation" process whereby earlier bloom is obtained on forcing the bulbs so treated. If the heat is applied, however, towards the end of the storage period, it delays the development of the shoots after planting with the consequent advantage that early succulent growth, which is readily infected with the yellow disease, is avoided. An additional and even more important reason for the use of the high temperature during September is the fact that this has proved to be a successful

way of preventing the formation of the primary lesions from infected bulbs previously described. The reason for this is not clear, but in some way the organisms responsible for the primary lesions are inactivated, perhaps by means of the drying out of the tissues in the neck of the bulb in which these organisms are located. The heat treatment also intensifies the decay of the badly diseased bulbs making them more obvious and so ensuring their ready elimination on inspection.

Excessive use of nitrogenous fertilizers should be avoided particularly where the presence of this disease is suspected, for the rapid succulent growth produced under these conditions is particularly susceptible to attack.

SUMMARY

1. The symptoms on the leaves and bulbs of hyacinth plants affected with the yellow disease (*Pseudomonas Hyacinthi* (Wakker) E.F.S.) are described.

2. The organism does not live over in the soil, but is re-introduced each year in diseased bulbs, and is spread principally by splashing rain.

3. Marked susceptibility is exhibited by certain varieties and a degree of resistance by others.

4. The disease is controlled in Holland by:

- (a) Field inspection by the grower with the isolation of diseased plants beneath inverted pots, and the enclosing of diseased areas with sheets of "eterniet".
- (b) Field inspection by the Hyacinth Association and limiting the sale only to bulbs which have a clean bill of health.
- (c) The removal of diseased material at bulb inspection.
- (d) A hot air treatment of the bulbs in the storage houses.
- (e) The avoidance of excessive nitrogenous fertilization.



Two transversely and longitudinally cut hyacinth bulbs affected with "yellow disease."
Note in the lower pair that the disease has descended through the three outer scales, entered and destroyed the basal plate, and is working upwards in the other scales, having already caused the destruction of the flower bud.

(Photo by F. L. Drayton).

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